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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/634,490	08/05/2003	P. Nick Lawrence	066300.0136	7049

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BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

EXAMINER	
HIRL, JOSEPH P	

ART UNIT	PAPER NUMBER
2129	

DATE MAILED: 11/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/634,490	LAWRENCE ET AL.	
	Examiner	Art Unit	
	Joseph P. Hirl	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44 and 48-53* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-44 and 48-53* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to an AMENDMENT entered September 21, 2006 for the patent application 10634490 filed on August 5, 2003.

2. The First Office Action of June 21, 2006 is fully incorporated into this Office Action by reference.

Status of Claims

3. Claims 1-44 and 48-53 are pending.

Claim Objections

4. Material cited in claims 49 and 52 regarding a cardinal tensor product is required to be appropriately disclosed in the specification. Also, material cited in claims 50 and 53 regarding ordinal space and ordinal tensor product is required to be appropriately disclosed in the specification. Such disclosure must be sufficient to allow one of ordinary skill in the art to replicate the invention. These objections must be corrected.

Claim Rejections - 35 USC § 101

5. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-53 are rejected under 35 U.S.C. § 101 for nonstatutory subject matter. The computer system must set forth a practical application of § 101 judicial exception to produce a real-world result. Benson, 409 U.S. at 71-72, 175 USPQ at 676-77. The invention is ineligible because it has not been limited to a substantial practical application.

In determining whether the claim is for a "practical application," the focus is not on whether the steps taken to achieve a particular result are useful, tangible, and concrete, but rather that the final result achieved by the claimed invention is useful, tangible and concrete. If the claim is directed to a practical application of the § 101 judicial exceptions producing a result tied to the physical world that does not preempt the judicial exception, then the claim meets the statutory requirement of 35 U.S. C. § 101.

The invention must be for a practical application and either:

1). specify transforming (physical thing – article) or

2). have the Final Result (not the steps) achieve or produce a
useful (specific, substantial and credible),
concrete (substantially repeatable / non unpredictable), and
tangible (real world / non abstract) result
(tangibility is the opposite of abstractness).

A claim that is so broad that it reads on both statutory and non-statutory subject matter, must be amended, and if the specification discloses a practical application but

the claim is broader than the disclosure such that it does not require the practical application, then the claim must be amended.

Claims that perform operations using quantum/physical correlithm objects or calculate a tensor product, where the ***result*** is not a practical application, are not statutory. Claims that receive input values, code such input values, project such input values into a domain space, establish dimensions for such values and provide an output that represents special dimensions simply is manipulating numbers which is purely abstract and represents no result having a practical application. Claims 8, 15 and 35 do not have a result or output. Claims 22, 39 and 51 are computer program listings per se.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-44 and 48-53 are rejected under 35 U.S.C. 102(b) as being anticipated by Nielsen et al (Quantum Computation and Quantum Information, referred to as **Nielsen**).

Claims 1, 8, 15, 22, 29, 31, 35, 39, 43

Nielsen anticipates receiving input associated with a plurality of real states (**Nielsen**, p587: 17; Examiner's Note (EN): ¶ 13 applies for this examination);

establishing the plurality of real states from the input, each real state comprising an element of a real space (**Nielsen**, p587: 17); encoding the real states as a plurality of quantum objects, the quantum objects representing a correlithm object (**Nielsen**, p587: 17-19; EN: Alice encodes strings a and b as a block of qubits; from the specification @ p6:18-20 establishes a correlithm object as formed from arrays of quantum objects); projecting the correlithm object to the real space using a measurement basis (**Nielsen**, p587:27-28); determining a plurality of measurement values corresponding to the measurement basis (**Nielsen**, p587:29-37); retrieving the projected correlithm object according to the measurement values (**Nielsen**, p587:38-40); and providing output indicating the projected correlithm object (**Nielsen**, p588:1; such as correlithm object encoded by Alice; EN: Nielsen teaches simulation of a quantum computer using an ordinary computer –albeit inefficiently; ordinary computers have databases and storage media).

Claims 2, 9, 16, 23

Nielsen anticipates a quantum object of the plurality of quantum objects comprises an object selected from a group consisting of a quantum bit, a quantum register, and an ebit (**Nielsen**, p587: 17-19).

Claims 3, 10, 17, 24, 32, 36, 40

Nielsen anticipates encoding the real states as the quantum objects comprises assigning a plurality of values to the real states (**Nielsen**, p587: 17-28).

Claims 4, 11, 18, 25

Nielsen anticipates encoding the real states as the quantum objects comprises adjusting a characteristic of a plurality of subatomic particles according to a distribution, each subatomic particle corresponding to a real state (**Nielsen**, p14: 12-23; p 81:4-12; EN: qubits manifest the property of superposition where the states of the qubits are set by characteristic distribution).

Claims 5, 12, 19, 26, 33, 37, 41

Nielsen anticipates each quantum object is associated with a probability; and The measurement values are determined in accordance with the probabilities (**Nielsen**, p14:12-23; p 81:4-12; EN: qubits manifest the property of superposition where the states of the qubits are set by characteristic distribution or probabilities).

Claims 6, 13, 20, 27

Nielsen anticipates comprising performing an intermediate operation prior to determining the plurality of measurement values corresponding to the measurement basis (**Nielsen**, p587:17-19: EN: the intermediate operation is the encoding of the classical bits).

Claims 7, 14, 21, 28, 34, 38, 42

Nielsen anticipates establishing a plurality of predicted values corresponding to the measurement basis (**Nielsen**, p588:9-15); comparing the measurement values with the predicted values using a metric (**Nielsen**, p588:9-15; EN: t is the metric); and retrieving the projected correlithm object in accordance with the comparison (**Nielsen**,

p588:9-15; EN: m is the result provided from the arrays (Correlithm object) formed from qubits).

Claim 30, 44

Nielsen anticipates receiving input associated with a plurality of real states (**Nielsen**, p587:17); establishing the plurality of real states from the input, each real state comprising an element of a real space (**Nielsen**, p587:17); encoding the real states as a plurality of quantum objects by assigning a plurality of random values to the real states, and by adjusting a characteristic of a plurality of subatomic particles according to a distribution, each subatomic particle corresponding to a real state, the quantum objects representing a correlithm object, a quantum object of the plurality of quantum objects comprising an object selected from a group consisting of a quantum bit, a quantum register, and an ebit (**Nielsen**, p14:12-23; p 81:4-12; p587:17-19; EN: Alice encodes strings a and b as a block of qubits; from the specification @ p6:18-20 establishes a correlithm object as formed from arrays of quantum objects; qubits manifest the property of superposition where the states of the qubits are set by characteristic distribution); projecting the correlithm object to the real space using a measurement basis (**Nielsen**, p587:27-28); performing an intermediate operation prior to determining the plurality of measurement values corresponding to the measurement basis (**Nielsen**, p587:17-19: EN: the intermediate operation is the encoding of the classical bits); determining a plurality of measurement values corresponding to the measurement basis, each quantum object associated with a probability, and the measurement values determined in accordance with the probabilities (**Nielsen**, p14:12-

23; p 81:4-12; p587:29-37; EN: qubits manifest the property of superposition where the states of the qubits are set by characteristic distribution or probabilities); and retrieving the projected correlithm object according to the measurement values by (**Nielsen**, p587:38-40): establishing a plurality of predicted values corresponding to the measurement basis (**Nielsen**, p588:9-15); comparing the measurement values with the predicted values using a metric (**Nielsen**, p588:9-15; EN: t is the metric); retrieving the projected correlithm object in accordance with the comparison (**Nielsen**, p588:9-15; EN: m is the result provided from the arrays (Correlithm object) formed from qubits); and providing output indicating the projected correlithm object(**Nielsen**, p588:1; such as correlithm object encoded by Alice.

Claims 48, 51

Nielsen anticipates a database operable to store data (**Nielsen**, p4:43-47; p5:1; EN: computers have databases); and a server system coupled to the database and operable to (**Nielsen**, p4:43-47; p5:1; EN: computers have databases; servers are computers): generate a first set of one or more first correlithm objects at a correlithm object generator, each first correlithm object representing a first orthonormal basis vector (**Nielsen**, p71:32-38; p72:1-4; p73:1-2; EN: correlithm objects are vectors; |I and |j are orthonormal bases for spaces V and W); generate a second set of one or more correlithm objects at the correlithm object generator, each second correlithm object representing a second orthonormal basis vector (**Nielsen**, p71:32-38; p72:1-4; p73:1-2; EN: correlithm objects are vectors; |I and |j are orthonormal bases for spaces V and W); perform a tensor operation on the first set and the second set to generate a tensor

product of the first set and the second set, the tensor product comprising a plurality of third orthonormal basis vectors (**Nielsen**, p71:32-38; p72:1-4; p73:1-2); and provide output indicating the tensor product (**Nielsen**, p71:32-38; p72:1-4; p73:1-2).

Claims 49 and 52

Nielsen anticipates the tensor product comprises a cardinal tensor product (**Nielsen**, p71:32-38; p72:1-4; p73:1-2; EN: the limitation of cardinal sensor product is not disclosed in the specification and the Examiner consequently does not treat such terminology as a limit in the subject claims).

Claims 50 and 53

Nielsen anticipates the one or more first correlithm objects are organized as one or more first string correlithm objects (**Nielsen**, p71:32-38; p72:1-4; p73:1-2); the one or more second correlithm objects are organized as one or more second string correlithm objects (**Nielsen**, p71:32-38; p72:1-4; p73:1-2); and the tensor product comprises an ordinal tensor product (**Nielsen**, p71:32-38; p72:1-4; p73:1-13; EN: the limitation of ordinal sensor product is not disclosed in the specification and the Examiner consequently does not treat such terminology as a limit in the subject claims).

Response to Arguments

8. The specification objection is withdrawn.

9. Applicant's arguments filed on September 21, 2006 related to Claims 1-44 and 48-53 have been fully considered but are not persuasive.

In reference to Applicant's argument:

Section 101 Reiection

Applicants respectfully submit that Claims 1-44 and 48-53 provide a practical application that produces a useful, tangible, and concrete result, and thus are allowable under 35 U.S.C. § 101.

1. Useful

Claims 1-44 and 48-53 have a specific, substantial, and credible utility, and thus the claims provide a practical application that produces a useful result. [T]he utility of an invention has to be (i) specific, (ii) substantial, and (iii) credible. Off. Gaz. Pat. Office, § IV.C.2.b(1) (Nov. 22, 2005) (citing MPEP Sec. 2107 and In re Fisher, 421 F.3d 1365, , 76 USPQ2d 1225, 1230 (Fed. Cir. 2005) (citing the Utility Guidelines with approval for interpretation of "specific" and "substantial")).

As an example, independent Claim 1 recites "retrieving the projected correlithm object," where "real states [are encoded] as a plurality of quantum objects, the quantum objects representing a correlithm object." The utility of Claim 1 is sufficiently specific, substantial, and credible. Accordingly, Claim 1 provides a practical application that produces a useful result. For analogous reasons, Claims 2-44 provide a practical application that produces a useful result.

As another example, independent Claim 48 recites "performing a tensor operation on the first set and the second set to generate a tensor product of the first set and the second set." The utility of Claim 48 is sufficiently specific, substantial, and credible. Accordingly, Claim 48 provides a practical application that produces a useful result. For analogous reasons, Claims 49-53 provide a practical application that produces a useful result.

2. Tangible

Claims 1-44 and 48-53 yield a result that is sufficiently non-abstract, and thus the claims provide a practical application that produces a tangible result. [T]he tangible requirement does require that ... the process claim must set forth a practical application of that Sec. 101 judicial exception to produce a real-world result. Off. Gaz. Pat. Office, § IV.C.2.b(2) (Nov. 22, 2005) (citing Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676-77 (1972) (invention ineligible because had "no substantial practical application.")). In other words, the opposite meaning of "tangible" is "abstract." Id.

As an example, independent Claim 1 recites "providing output indicating the projected correlithm object," which is sufficiently non-abstract. Thus, Claim 1 and its dependents provide a practical application that produces a tangible result. For analogous reasons, independent Claims 22, 29, 30, 31, 39, 43, and 44 and their dependents provide a practical application that produces a tangible result.

As another example, independent Claim 8 recites "an analyzer operable to: ... retrieve the projected correlithm object according to the measurement values," which is sufficiently non-abstract. Thus, Claim 8 and its dependents provide a practical application that produces a tangible result.

As another example, independent Claim 15 recites "server system ... operable to: ... retrieve the projected correlithm object according to the measurement values," which is sufficiently non-abstract. Thus, Claim 15 and its dependents provide a practical application that produces a tangible result. For analogous reasons, independent Claims 35 and its dependents provide a practical application that produces a tangible result.

As another example, independent Claim 48 recites "server system ... operable to: ... perform a tensor operation on the first set and the second set to generate a tensor product of the first set and the second set," which is sufficiently non-abstract. Thus, Claim 48 and its dependents provide a practical application that produces a tangible result.

As another example, independent Claim 51 recites "logic encoded in a computer readable storage medium and operable to: ... perform a tensor operation on the first set and the second set to generate a tensor product of the first set and the second set," which is sufficiently non-abstract. Thus, Claim 51 and its dependents provide a practical application that produces a tangible result.

3. Concrete

Claims 1-44 and 48-53 yield a result that is substantially repeatable and predictable, and thus the claims provide a practical application that produces a concrete result. The opposite of "concrete" is unrepeatable or unpredictable. Off. Gaz. Pat. Office, § IV.C.2.b(3) (Nov. 22, 2005). [A] process must have a result that can be substantially repeatable or the process must substantially produce the same result again. Id. (citing In re Swartz, 232 F.3d 862, 864, 56 USPQ2d 1703, 1704 (Fed. Cir. 2000) (where asserted result produced by the claimed invention is "irreproducible" claim should be rejected under section 101)).

As an example, independent Claim 1 recites "providing output indicating the projected correlithm object." The result of Claim 1 is substantially repeatable and predictable. Accordingly, Claim 1 provides a practical application that produces a concrete result. For analogous reasons, Claims 2-44 provide a practical application that produces a concrete result.

As an example, independent Claim 48 recites "provide output indicating the tensor product." The result of Claim 48 is substantially repeatable and predictable. Accordingly, Claim 48 provides a practical application that produces a concrete result. For analogous reasons, Claims 248-53 provide a practical application that produces a concrete result.

Examiner's response:

¶ 13 applies. 35 USC 101 requires that the result be a practical application. Applicant's claims represent algorithms that merely manipulate numbers with no cited practical application. On page 6, lines 7-11 of the application applicant cites the following:

> Quantum objects may comprise high-dimensional real or complex-valued state spaces that include quantum bits ("qubits"), quantum registers ("quregs") of q>o qubits, and ebits that include quantum registers of q>1 qubits.

Complex-valued manifests real and imaginary numbers, as a set related to a quantum object, and real merely means the representation of such real number ... but numbers nontheless. The claims of the applicant cite algorithms, to include tensor operations that represent manipulating numbers which is pure abstractness and not patentable under 35 USC 101. The results, cited in the claims, simply are not practical applications. Further, to a person having ordinary skill in the art, quantum theory

applied to quantum objects sets forth wave application which is not patentable as a physical characteristic of the form of energy O'Reilly, 56 U.S. (15 How.) at 112-14.

Examination Considerations

10. The claims and only the claims form the metes and bounds of the invention. "Office personnel are to give the claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris,* 127 F.3d 1048, 1054-55, 44USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater*, 415 F.2d, 1393, 1404-05, 162 USPQ 541, 550-551 (CCPA 1969)" (MPEP p 2100-8, c 2, l 45-48; p 2100-9, c 1, l 1-4). The Examiner has full latitude to interpret each claim in the broadest reasonable sense. Examiner will reference prior art using terminology familiar to one of ordinary skill in the art. Such an approach is broad in concept and can be either explicit or implicit in meaning.

11. Examiner's Notes are provided with the cited references to prior art to assist the applicant to better understand the nature of the prior art, application of such prior art and, as appropriate, to further indicate other prior art that maybe applied in other office actions. Such comments are entirely consistent with the intent and spirit of compact prosecution. However, and unless otherwise stated, the Examiner's Notes are not prior art but a link to prior art that one of ordinary skill in the art would find inherently appropriate.

12. Unless otherwise annotated, Examiner's statements are to be interpreted in reference to that of one of ordinary skill in the art. Statements made in reference to the condition of the disclosure constitute, on the face of it, the basis and such would be obvious to one of ordinary skill in the art, establishing thereby an inherent prima facie

13. Examiner's Opinion: ¶¶ 10-12 apply. The Examiner has full latitude to interpret each claim in the broadest reasonable sense.

Conclusion

14. Claims 1-44 and 48-53 are rejected.

Correspondence Information

15. Any inquiry concerning this information or related to the subject disclosure should be directed to the Primary Examiner, Joseph P. Hirl, whose telephone number is (571) 272-3685. The Examiner can be reached on Monday – Thursday from 6:00 a.m. to 4:30 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, David R. Vincent can be reached at (571) 272-3080. Any response to this office action should be mailed to:

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Joseph P. Hirl
Primary Examiner
November 6, 2006